

Mars Hill Windfarm Post-Development Third-Quarter Sound Level Study Peer Review

MARS HILL, MAINE

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Review Basis

UPC Wind Management LLC/Evergreen Wind Power LLC (UPC) operates a 28 unit wind facility along the ridge line of Mars Hill in Mars Hill, Maine. At the request of the Maine Department of Environmental Protection (MDEP) this continuing peer review is undertaken to provide expert opinion as to:

"Whether post-development reporting is reasonable and technically correct according to standard engineering practices and the Department Regulations on Control of Noise (06-096 CMR 375.10) and

Whether the report provide a reasonable basis upon which to determine compliance or non-compliance with the operational noise limits set forth in the Control of Noise rules and the variance given in Department Order L-21635-26-A-N/L-21365-TG-B-N, dated June 1, 2004."

The post-development ambient and operational noise studies were completed by Resource Systems Engineering (RSE)¹ in December 2006 (ambient), May 2007 (ambient and operation), September 2007 (operation) and January 2008 (operation). Each section of the April 11, 2008 report will be generally critiqued unless detailed criticism is given.

1.0 Introduction

The stated objective of this sound level study is to compare wind farm operation sound levels with predicted estimates and evaluation of the ambient sound levels in the vicinity of the wind farm.

The Resource Systems Engineering (RSE) reports of June 21, 2007 and November 2, 2007 are referenced for additional details concerning previous portions of the sound level study.

2.0 Sound and Decibels

Informational

3.0 Site Description

Referenced to RSE report June 21, 2007.

4.0 MDEP Standards

Referenced to RSE report June 21, 2007.

¹ *Sound Level Study & Operational Sound Level Monitoring Maine Department Of Environmental Protection Order No.L-21635-26-AN*, Resource Systems Engineering

5.0 Sound Level Model Estimates for Wind Farm Operation

Referenced to RSE report June 21, 2007.

6.0 Ambient Sound Levels

Referenced to RSE report June 21, 2007.

7.0 Operating Sound Levels

Operations sound testing began the afternoon of January 9, 2008 and continued for approximately 96 hours into the afternoon of January 13, 2008. Measurements were made under varying wind and operating conditions in order to determine by measurement sound levels at community monitoring positions during routine operation of the wind farm. Measured operations sound levels are compared to ambient sound levels and predicted sound levels.

7.1 Measurement Procedures

Stated primary objective: to measure wind farm levels at nearby protected locations during conditions when the sound from the wind farm is most noticeable.

A single 7 inch diameter foam windscreen was rotated between a spot measurement instrument and site MP-1 (see third-quarter report page 11 annotation).

Monitoring site relocations seem reasonable and consistent with objectives. Site MP-1A was added at this reviewer's request to measure surface wind without nearby obstruction and to collect operation sound levels away from the hedgerow proximal to the site MP-1. Five of the eight monitoring stations were also assessed for meteorological conditions with portable MET stations. Wind data was measured at a height of 8 to 10 feet above grade and concurrently on windmill towers.

Sound level measurements were periodically observed by field technicians.

7.2 Measurement Results

Again, third-quarter ambient level adjustments were estimated from typical hourly L_{Aeq} readings during periods of the May 2007 operations testing when winds were light or calm and wind turbines were not operating (or no adjustment was made when operating levels were found to be at or below the May 2007 ambient levels recorded).

"When ambient sounds from the surface winds and other sources diminish, while strong upper level winds drive turbines near full power, the L_{Aeq} and L_{A50} are nearly identical. This demonstrates that, during periods when wind turbines sounds are predominant, the

L_{A50} is a reliable indicator of the hourly equivalent sound level (L_{Aeq}) from operation of wind turbines." -see *Conclusion*.

Operation sound levels during blustery winds on January 9 & 10 were estimated using time history plots and are consistent with previously observed measurements.

7.3 Short Duration Repetitive and Tonal Sounds

7.4 Operating Conditions and Wind Predictions

8.0 Findings and Recommendations

This third-quarter study provided an opportunity to sample wind turbine sound during blade icing and crusted snow conditions.

RSE recommends additional sound level measurements of wind farm operations during the spring using the same measurement protocol as was used during the third quarterly testing.

RSE recommends, "As an additional option, UPC Wind should shut down selected turbines for brief periods (e.g. 10 minutes) of fourth quarterly testing. This would enable measurement of near "real-time" ambient sound levels during operating periods for purposes of adjusting sound levels measured while wind turbines are at moderate to full operations.

Conclusion - (Peer Review)

Measurements during the January 9 - 13 period were complicated by very high winds/gusts, precipitation, and key MET station failures (at MP-1 and MP-2). This study period provided an opportunity to sample wind turbine sound during blade icing and crusted snow conditions, which may have affected measured results during January 12 and 13, but did not indicate a significant increase in sound levels over previously observed.

The L_{A50} may be a reliable indicator of the hourly equivalent sound level (L_{Aeq}) from operation of wind turbines during a relatively stable atmosphere, when surface winds are light and the L_{Aeq} and L_{A50} are in agreement. Sound level statistical metrics calculated from measurements made during wind turbine operation, likely reflect both wind and sound variations. Sufficient data has not been gathered to reliably correlate wind parameters with sound exceedance levels, nor perhaps can it be under high wind/gust conditions in mountainous terrain.

Operation sound level estimates from January 9 & 10 were made from fragments of data and correlating field notes. These estimates should not be seen as reflecting the actual range, but rather as a subset of the range of operating sound levels during the period.

Operation noise level estimates calculated using the hourly L_{A50} introduce a statistical metric other than the hourly L_{Aeq} , which breaks step with the existing regulation. During sound measurements when hourly L_{Aeq} and L_{A50} are equal there is no reason to diverge from using the hourly L_{Aeq} .

Again, sheltering sound and weather stations to minimize microphone wind interference is not always desirable (MP-1). Localized intrusive noise, from the hedgerow may have been included in operation sound levels during this report and future reports (ambient and operation sound levels). Using the enlarged windscreen (7") at MP-1 might factor out some ambient sound, but not that produced in the overhead treetops. Nearby residential impact is not well represented by sound levels measured and site MP-1 because of the hedgerow and the resulting increase in localized ambient noise.

The range of operating hourly average sound levels at site MP-8 reported exceeds 50 dBA (1-4 a.m. January 13, 2008 - using either metric, *operations hourly L_{A50} - ambient hourly L_{Aeq} or operations hourly L_{Aeq} - ambient hourly L_{Aeq}*).

It is the opinion of the reviewer that this 3rd assessment of the project indicates, once again, substantial compliance, but reports operation average sound levels ranging near or slightly above protected location permitted upper limits near residences represented by MP-1 and MP-8, as established in the Control of Noise rules and the variance given in Department Order L-21635-26-A-N/L-21365-TG-B-N, dated June 1, 2004. The study is reasonable, and technically correct according to standard engineering practices and the Department Regulations on Control of Noise (06-096 CMR 375.10).

Recommendations

Proceed with fourth-quarter measurements as recommended by RSE.

Microphone wind interference should be controlled during sound measurements when surface wind speeds exceed 12 miles an hour using secondary windscreens. Site MP-1A, should be equipped with a secondary windscreen during periods when its wind speed will likely exceed 12 mph.

Operation noise levels should be reported in regulation specified metrics unless otherwise permitted by the department.

Ambient (operation conditions) sound levels should be established (May 2007, calm periods or re-measured) to allow for definitive calculation of operation hourly L_{Aeq} for comparison with department compliance conditions.

Fourth-quarter wind turbine shutdown periods should be selected during periods of surface winds less than 12 mph, especially at sites MP-1, MP-1A and MP-8.